NON-PUBLIC?: N
ACCESSION #: 9107230370
LICENSEE EVENT REPORT (LER)

FACILITY NAME: CRYSTAL RIVER UNIT 3 (CR-3) PAGE: 1 OF 05

DOCKET NUMBER: 05000302

TITLE: Water Intrusion Into Pump Motor Leads to Loss of Circulating Water Pump, Emergency Feedwater Actuation, and a Manual Reactor Trip
EVENT DATE: 04/20/91 LER #: 91-003-01 REPORT DATE: 07/17/91

OTHER FACILITIES INVOLVED: N/A DOCKET NO: 05000

OPERATING MODE: 1 POWER LEVEL: 047

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR SECTION:
50.73(a)(2)(iv)

LICENSEE CONTACT FOR THIS LER:
NAME: W. K. BANDHAUER, NUCLEAR OPERATIONS TELEPHONE: (904) 795-6486
SUPERINTENDENT

COMPONENT FAILURE DESCRIPTION:
CAUSE: C SYSTEM: KE COMPONENT: MO MANUFACTURER: W120
REPORTABLE NPRDS: NO

SUPPLEMENTAL REPORT EXPECTED: NO

ABSTRACT:

On April 20, 1991, Crystal River Unit 3 was operating in MODE 1, at 47% rated thermal power, performing Main Condenser (COND) water box and Circulating Water Pump (CWP) maintenance. Two of the four COND water boxes were out of service. At 0650, CWP-1A tripped, removing cooling from the A COND and the Secondary Services Closed Cycle Cooling Water System (SC) which provides cooling to turbine and generator equipment. CWP-1D continued to supply its main COND with cooling water.

The operators began reducing power to take the turbine off line, then tripped the turbine as many turbine temperature alarms were received. The turbine trip was below the Anticipatory Reactor Trip System bypass setpoint so no automatic reactor trip resulted. After the turbine trip

automatic control systems and plant systems responded as designed; however, the configuration resulted in the Anticipated Transient Without Scram Mitigation System Actuation Circuitry (AMSAC) logic detecting Main Feedwater and Reactor Power input signals which met actuation setpoints. AMSAC initiated Emergency Feed Water (EFW) and the operator manually tripped the reactor due to initiation of EFW at power.

This event was caused by water intru
ion into the CWP motor during a
severe rainstorm. Corrective action will be to provide additional rain protection for the CWPs.

END OF ABSTRACT

EVENT DESCRIPTION

Beginning April 1, 1991, Crystal River Unit 3 reduced power to 75% to perform planned maintenance on Condenser Waterboxes KE,COND! and Circulating Water Pumps KE,P!(CWP) by removing one waterbox and its corresponding circulating water pump at a time. However, while performing planned maintenance on condenser waterbox B, power was subsequently reduced to 47% on 4/19/91 at about 1425, when condenser water box C developed a leak forcing its removal from service. This left the plant in the unusual condition of having only two functioning waterboxes, one in each condenser. Secondary Services Closed Cycle Cooling Water System KB! (SC) was being cooled by seawater from the 1A Circulating Water Pump KE,P! (CWP-1A).

At 0650 on April 20, 1991, before the B condenser waterbox could be returned to service, CWP-1A tripped. This left one water box functional in condenser "B" and none in condenser "A". It also left the secondary plant equipment such as the main turbine oil coolers, generator hydrogen cooler, etc. without cooling because the "A" Secondary Services heat exchanger KB,HX! was no longer receiving cooling water flow from the circulating water system. (See the attached drawing.)

The operators immediately began a run back of the plant at the maximum controllable rate. The operator's goal was to reduce power to
take the main turbine off line, and stabilize the plant. The operators also ordered the turbine building operator to place the 'B' Secondary Services Cooling heat exchanger in service because it would be supplied with cooling water from the remaining CWP on the "B" side condenser.

At 0653, before the "B" SC heat exchanger could be placed in service,

alarms occurred on turbine differential expansion. The shift supervisor instructed the operators to manually trip the turbine to protect plant equipment. When the turbine was tripped, power level was below the Anticipatory Reactor Trip System JC! (ARTS) setpoint (45% RTP), so there was no automatic reactor trip.

At 0654, the Anticipated Transient Without Scram Mitigation System Actuation Circuitry JE! (AMSAC) activated the Emergency Feedwater Initiation and Control BA!(EFIC) system, starting both Emergency Feedwater Pumps BA,P! (EFPs), and feeding both steam generators. The operators reviewed their indications and realized there was inadequate main feedwater flow for their present power level and that EFW flow to both steam generators was occurring. In accordance with normal and abnormal operating procedure guidance, the operators tripped the reactor. The combination of main and emergency feedwater flow caused the reactor coolant system to cool down approximately 8 degrees fahrenheit below the nominal post trip temperature. The resulting decrease in pressurizer water level required the operators to start a second makeup pump BQ,P! and open two High Pressure Injection nozzle valves BQ,FCV! to increase the supply of water to the reactor coolant

system. The second nozzle valve was open for 15 seconds and then closed because pressurizer level was recovering from the low level condition.

The operators took manual control of main feedwater, verified that it responded properly, and stopped Emergency Feedwater. The operators then reset the AMSAC and EFIC systems. The elapsed time from CWP-1A trip to reactor trip was four minutes and forty three seconds.

This event is being reported as required by 10 CFR 50.73(a)(2)(iv), because it involved the actuation of the Reactor Protection and Emergency Feedwater Systems.

CAUSE

The cause of this event was water intrusion into the circulating water pump motor during a severe storm leading to a trip of CWP-1A. The water intrusion degraded the motor winding insulation and caused a short circuit in the motor.

The cause of the AMSAC actuation was a set of valid input signals. The input signals for Reactor Power and FW Flow met their setpoint values for the actuation. Actuation conditions for AMSAC are reactor power greater than 25% rated thermal power and feedwater flow less than 17% on both the

main feedwater and startup feedwater flow channels. Following the turbine trip, the "load demand" input to the ICS is eliminated and the system controls main feedwater flow to maintain the OTSGs at their low level limit setpoint. The OTSG level was well above this limit and therefore, by design, the ICS temporarily stopped feeding MFW to reduce the OTSG level to the low level limit setpoint. This temporary lack of MFW flow at a power level above the AMSAC bypass value (25%) caused AMSAC to initiate EFW.

The immediate cause of the manual reactor trip was the recognition by the operators that indicated main feedwater was inadequate for the corresponding power level and that Emergency Feedwater was flowing to both steam generators with reactor power greater than 5% RTP. The reactor trip was not mandated by procedure. However, there is guidance provided by procedure to minimize the amount of time the reactor is critical with emergency feedwater flow to the OTSGs. Additionally, there are cautionary notes in the procedures that instruct the operators not to leave the reactor critical unless main feedwater (MFW) will be recovered immediately. The operators believed they had lost main feedwater flow and that there was a problem with feedwater control. The shift supervisor looked at the indications for Main and Emergency feedwater flow, steam generator levels, reactor power, main condenser cooling and decided to place the reactor in a known safe state.

EVENT EVALUATION

There was no threat to the health and safety of the general public from this event. There was no release of radioactive material above Technical Specification limits. Since the reactor trip was manually initiated by the operators, the Reactor

Protection System setpoints were not reached. All safety systems responded as designed.

Under a different set of initial conditions, a minimum of one water box in service in each condenser, this event would not have occurred. Having both SC heat exchangers in service simultaneously would have assured some cooling was available to the secondary plant equipment allowing the operators additional time to reduce power.

CORRECTIVE ACTION

A plant modification had previously been initiated to provide protection of the circulating water pump from water intrusion during rainstorms. An

interim cover has been erected over the pumps and a permanent structure will be erected.

Additional guidance has been provided to the operators to optimize SC heat exchanger and CWP combinations to assure maximum reliability when condenser waterboxes are out of service. Florida Power is taking additional actions to prevent recurrence of this event. These include changes to AMSAC initiation setpoints if determined to be appropriate and evaluating changes to automatic feedwater runback to assure the runback rate is consistent with reactor runback capability.

PREVIOUS SIMILAR OCCURRENCES

There have been five previous failures of the CWPs during rainstorms; these were attributed to lightning. Surge protection was installed to correct the problem. None of these previous events caused the loss of SC cooling and none required the manual trip of either the turbine or reactor as did this event.

Figure "CW and SC System Schematic Diagram" omitted.

Florida
Power
CORPORATION
Crystal River Unit 3
Docket No. 50-302

July 17, 1991

3F0791-03

U. S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, D. C. 20555

Reference: Licensee Event Report (LER) 91-03-01

Dear Sir:

Enclosed is Licensee Event Report (LER) 91-03-01 which is submitted in accordance with 10 CFR 50.73.

This supplement includes additional information and provides the status of the subject item.

Sincerely,

G. L. Boldt
Vice President
Nuclear Production

WLR:mag

Enclosure

xc: Regional Administrator, Region II
NRR Project Manager
Senior Resident Inspector

A Florida Progress Company

*** END OF DOCUMENT ***